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(54) Exhaust gas purifying device.

(57) An exhaust gas purifying device of a motorcycle, for example, in which an exhaust gas from an exhaust port of an engine is purified by a member provided with a catalyst disposed in a cylindrical muffler provided with an exhaust pipe section connected to the engine exhaust gas port, is provided with a catalyst plate means (16) to which a catalyst is applied. The catalyst plate means (16) is disposed so as to extend throughout a longitudinal direction of the exhaust pipe section (11) at substantially a diametrically central portion in cross section of the exhaust pipe section (11). The catalyst plate means (16) including at least one plate member of a sandwich structure comprises a central plate (16) and catalyst layers disposed on both side surfaces of the central plate (16), and coating layers may be further disposed between the central plate and the catalyst layers. The catalyst plate means can be composed of one catalyst plate member and can be disposed at a diametrical portion of the exhaust pipe section or at a diametrically central portion of the exhaust pipe section within a range of 1/3d to 2/3d, wherein a symbol d designates an inner diameter of the exhaust pipe section, offset from an inner surface thereof.

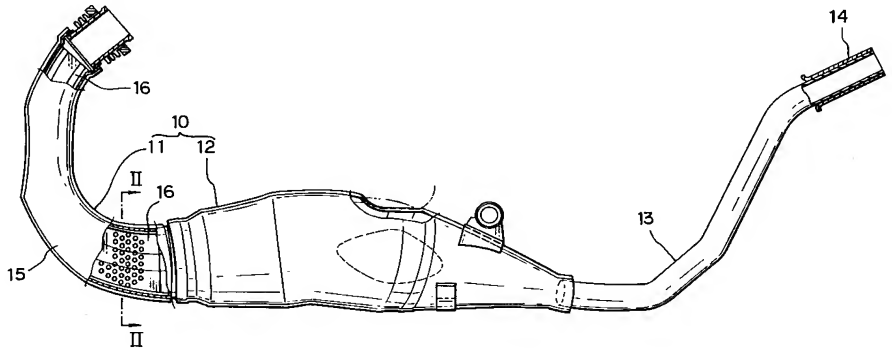

FIG. 1

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BACKGROUND OF THE INVENTION

The present invention relates to an exhaust gas purifying device mounted to an engine unit of, for example, a motorcycle.

In a conventional technology, is utilized for an exhaust system of an engine unit of, for example, a motorcycle an exhaust gas purifying device in which the exhaust gas is purified by carrying out oxidation reaction utilizing catalyst contact reaction between unburnt constituents such as and/or harmful constituents such as carbon monoxide and hydrocarbon contained in the exhaust gas and a catalyst. The catalyst is utilized for increasing temperature of an engine exhaust gas to carry out the oxidation reaction. In such conventional exhaust gas purifying device, the exhaust gas is purified by the contact of the exhaust gas to the catalyst disposed in a muffler connected to an exhasut gas tube.

The muffler of the motorcycle generally comprises an exhaust pipe section and a muffler section and is provided with a plate member to which a catalyst is applied. The plate member comprises two plates bent in an arcuate manner adjacently to the inner wall of a muffler body and the plates are mounted to the inner wall surface of the muffler body keeping a clearance of 1 to 5 mm with respect to the inner wall surface so that the exhaust gas flowing through the muffler can be brought into contact with the catalyst applied to the plate member.

In the construction of the conventional exhaust gas purifying device of the structure described above, however, the plates with the catalyst are disposed cylindrically in an assembled state along the inner wall surface of the muffler body adjacently to the inner wall surface thereof and a portion of the exhaust gas to be brought into contact with the catalyst of the plate member has a relatively low temperature in the surrounding portion of a tubular passage. Therefore, it takes much time to increase the temperature to start the catalytic reaction, hence resulting in degradation of an exhaust gas purification performance.

In addition, a surface temperature of the muffler body increases high because the plates with catalyst are disposed near the surface of the muffler body. As a result, it becomes necessary to sufficiently take countermeasures against the thermal harmful influences suferred from the heated hot surface of the muffler body, so that there are several problems such as an increasing of cost and a tendency to a decreasing of an output power of the engine due to a significantly large influence effecting on a diffuser.

SUMMARY OF THE INVENTION

An object of the present invention is to substantially eliminate defects or drawbacks encountered in the prior art described above and to provide an exhaust gas purifying device capable of improving a catalytic reaction between the engine exhaust gas and the device to enhance the exhaust gas purifying performance and reducing thermal influence on a muffler as well as improving an engine power.

This and other objects can be achieved according to the present invention by providing an exhaust gas purifying device in which an exhaust gas from an exhasut port of an engine is purified by a member provided with a catalyst disposed in a cylindrical muffler provided with an exhaust pipe section connected to the engine exhaust gas port, the device being characterized in that a catalyst plate means to which a catalyst is applied is disposed so as to extend throughout a longitudinal direction of the exhaust pipe section at substantially a diametrically central portion in cross section of the exhaust pipe section.

In preferred embodiments, the catalyst plate means including at least one plate member of a sandwich structure comprising a central plate and catalyst layers disposed on both side surfaces of the central plate, and coating layers may be further disposed between the central plate and the catalyst layers.

The catalyst plate means is composed of one catalyst plate member and is disposed a diametrical portion of the exhaust pipe section or in the diametrically central portion of the exhaust pipe section within a range of 1/3d to 2/3d, wherein a symbol d designates an inner diameter of the exhasut pipe section, from an inner surface thereof.

According to the present invention of the characters described above, the catalyst plate to which a catalyst is applied is disposed at the diametrically central portion or near of the exhaust gas section of the muffler, and when the exhaust gas flows flom the engine exhaust port into the muffler, a high temperature portion of the exhaust gas contacts the catalyst. Accordingly, the catalytic reaction promptly and positively starts to thereby enhance the exhaust gas purifying performance. Moreover, since the catalyst plate is disposed at substantially the central portion in the muffler, a large distance exsits between it and the inner wall surface of the muffler, so that the increasing of the temperature of the muffler surface can be significantly suppressed, resulting in the improvement of the engine output power.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

Fig. 1 is a side view, partially in section, of a

muffler provided with an exhaust gas purifying device according to the present invention;

Fig. 2 is a cross section taken along the line II-II of Fig. 1 showing one embodiment of the exhaust gas purifying device;

Figs. 3 to 5 are also sectional views similar to that of Fig. 2 showing other embodiments according to the present invention;

Fig. 6 is a sectional view in an enlarged scale of a portion of a catalyst plate of the exhaust gas purifying device;

Fig. 7 is a graph showing a temperature distribution of the exhaust gas in the muffler;

Fig. 8 is a graph showing the surface temperature of the muffler in accordance with the present invention in comparison with a prior art;

Fig. 9 is a graph showing an engine output according to the present invention in comparison with the prior art;

Fig. 10 is a side view of a motorcycle equipped with the muffler to which the exhaust gas purifying device is applied;

Fig. 11 is an enlarged view of the muffler shown in Fig. 10; and

Fig. 12 is a sectional view taken along the line XII-XII of Fig. 11 showing a conventional exhaust gas purifying device.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

For a better understanding of the present invention, a prior art will be first explained with reference to Figs. 10 to 12.

Fig. 10 shows a motorcycle of the type to which the present invention is preferably applicable and the motorcycle 1 is equipped with a muffler 2 which is connected to an exhaust pipe connected to an engine exhaust port.

As shown in Fig. 11, the muffler 2 of the motorcycle 1 generally comprises an exhaust pipe section 3 and a muffler section 4. A silencer 7 is connected to the muffler 2 through an exhaust pipe 6. In such a muffler 2, as shown in Fig. 12, a pair of semi-circular plates 8 and 8 to which catalyst is applied are disposed and the plates 8 and 8 are bent in an arcuate manner adjacently to the inner wall of a muffler body 5. The plates 8 are mounted to the inner wall surface of the muffler body 5 keeping a clearance of 1 to 5 mm with respect to the inner wall surface so that the exhaust gas flowing through the muffler 2 can be brought into contact with the catalyst applied to the plates 6 and 6. An exhaust gas purifying device of the conventional muffler of the motorcycle is constructed as described above.

The conventional exhaust gas purifying device, however, provides problems described hereinbefore.

The present invention conceived for eliminating the problems of the prior art will be described hereunder with reference to Figs. 1 to 9.

First, referring to Fig. 1 showing a muffler 10 of a motorcycle of the type shown in Fig. 10 equipped with an exhaust gas purifying device according to the present invention. The muffler 10 comprises a muffler body 15 including an exhasut pipe section 11 which is connected to an engine exhaust port of the motorcycle and a muffler section 12 coupled with the exhaust pipe section 11. The muffler section 12 has an expansion chamber formed by swelling a portion of the muffler body 15. An exhaust pipe 13 is connected to the downstream side of the muffler section 12, and a silencer 14 is connected to the exhasut pipe 13. In this embodiment, the muffler 10 is referred to a muffler located on the left side of the motorcycle body.

Fig. 2 is a cross section of the exhaust pipe section 11 of the muffler 10 representing an exhaust gas purifying device according to one embodiment of the present invention. Referring to Fig. 2, the muffler body 15 of the muffler 10 is formed of a pair of inner and outer halves 15a and 15b, in which the inner body 15a is to be disposed on the side of a mototcycle body and the outer body 15b is to be disposed on the outside. The inner and outer muffler bodies 15a and 15b each has a semicircular cross section and constitutes a cylindrical pipe as the muffler body 15 when mated with each other. A plate 16 to which a catalyst is applied is disposed in the diameter direction at the central portion of the cross section of the muffler body 15 so that both the side ends of the plate 16 are secured, for example by means of welding, to the joined portions of the inner and outer muffler boies 15a and 15b along the longitucinal directions of the exhaust pipe section 11. The plate 16 will be called a catalyst plate 16 hereinlater for the sake of convenience.

Fig. 3 shows another embodiment according to the present invention, in which the catalyst plate 16 is fixedly secured in the vertical direction, as viewed, in the interior of the inner body 15a side. Namely, the catalyst plate 16 is disposed at a portion offset from the diameter direction of the muffler body 15 within a range of 1/3d to 2/3d ($1/3d < \ell < 2/3d$), wherein a symbol d is an inner diameter of the muffler body, and this range will be referred to as a central portion hereinlater offset to the side of the inner wall surface of the inner muffler body 15a in comparison with the location of Fig. 2.

Fig. 4 shows a further embodiment according to the present invention, in which the catalyst plate 16 is disposed at the central portion similar to that

of Fig. 3, but in the embodiment of Fig. 4, the catalyst plate 16 is provided with a supplementary rib portion 16a at an intermediate portion thereof so as to increase the strength of the catalyst plate 16 as well as to enlarge the surface area of the catalyst.

Fig. 5 shows a still further embodiment according to the present invention, in which the catalyst plate 16 of the type shown in Fig. 3 is mounted to each of the inner and outer bodies 15a and 15b in the central portion of the muffler body 15. Namely, two catalyst plates are disposed in the central portion, i.e. within the range from 1/3d to 2/3d (d: inner diameter of the muffler body 15), for example, in a centrally symmetrical manner. According to this embodiment, the total surface area of the catalyst can be increased as well as increasing of the strength.

With respect to the described preferred embodiments represented by Figs. 2 to 5, the catalyst plate 16 has a sandwich structure, for example, shown in Fig. 6 as an enlarged fragmental section.

Referring to Fig. 6, the catalyst plate 16 comprises a punched plate 17 arranged centrally of the sandwich structure, coating layers 18 applied on both the sides of the punched plate 17 and catalyst layers 19 applied to the outer surface of the coating layers 18, which are disposed for the purpose of improving a firm connection of the catalyst layers 19 to the outer surfaces of the punched plate 17. Although the punched plate 17 is utilized for improving the flow of the exhasut gas through punched holes of the plate 17, a blind plate with no holes may be also utilized.

In a preferred embodiment, it is desired to form the punched plate 17 with a stainless steel plate and to form the coating layers 18 by flame coating a ceramic material such as white aluminium material in ceramic state. As the catalyst 19, it is desired to utilize one for promoting the oxidization reaction to increase the temperature of the exhaust gas, and for this purpose, a catalyst mainly consisting of platinum and rhodium may be preferably utilized.

According to the type of the catalyst, the coating layers 18 may be eliminated.

The exhaust gas purifying device of each of the present embodiments will operates as follows.

In general, as shown in Fig. 7, the exhaust gas from the engine exhasut port flowing through the central portion of the exhaust pipe section of the muffler body 15 has a temperature higher than that flowing along the radially peripheral portion thereof. When the exhasut gas flows in the muffler body 15, the high-temperature exhaust gas flows through the central portion therein. According to the present invention, since the catalyst plate is arranged in the central portion of the flow passage, the high-temperature exhaust gas positively comes into contact with the catalyst, i.e. catalyst layers of the catalyst plate, and promptly reacts therewith. Therefore, the catalytic reaction will start promptly and the exhaust gas purification capability can be hence enhanced.

Furthermore, since the catalyst plate 16 is disposed in the central portion of the exhaust gas flow passage, the temperature of the inner wall surface of the muffler body 15 is not highly increased by the catalytic reaction in comparison with the conventional arrangement of the catalyst plate such as shown in Fig. 12. In this viewpoint, Fig. 8 shows a fact that the surface temperature of the muffler body according to the present invention is lower as indicated by the solid line A in comparison with the conventional one indicated by the dotted line B throughout the whole longitudinal length of the muffler 2.

In addition, as shown in Fig. 9, since the surface temperature of the muffler body is less increased, an influence caused by the temperature increasing less effects on the diffuser of the muffler, so that the lowering of the output power becomes less throughout the whole revolution range of the engine as indicated by the solid line C in comparison with the conventional muffler, such as shown in Fig. 12, indicated by the dotted line D.

In the foregoing embodiment, the exhaust gas purifying device is equipped for the muffler disposed on the left side of the motorcycle body, but substantially the same device is disposed to the muffler on the right side of the motorcycle body. In this case, when the catalyst plate is arranged in an offset manner such as shown in Fig. 3 or 4, the catalyst plate will be displaced on the side of the inner wall of the inner body half 15a.

It is to be understood that the present invention is not limited to the described preferred embodiment and many other changes and modification may be made without departing from the scope of the appended claim.

Claims

1. An exhaust gas purifying device in which an exhaust gas from an exhasut port of an engine is purified by a member provided with a catalyst disposed in a cylindrical muffler provided with an exhaust pipe section connected to the engine exhaust gas port, characterized in that a catalyst plate means to which a catalyst is applied is disposed so as to extend throughout a longitudinal direction of the exhaust pipe section at substantially a diametrically central portion in cross section of the exhaust pipe section.

2. A device according to claim 1, wherein said catalyst plate means including at least one plate member of a sandwich structure comprising a central plate and catalyst layers disposed on both side surfaces of the central plate.

3. A device according to claim 2, wherein said central plate is a punched plate provided with a plurality of perforations.

4. A device according to claims 2 or 3, wherein said central plate is a solid plate.

5. A device according to any one of claims 2 to 4, wherein said central plate comprises a stainless steel plate and said catalyst layers are mainly formed of plutinum and rhodium.

6. A device according to any one of claims 2 to 5, wherein coating layers are further disposed between the central plate and the catalyst layers, said coating layers being formed by flame coating white aluminium in ceramic state.

7. A device according to any one of claims 1 to 6, wherein said catalyst plate means is one catalyst plate member and is disposed a diametrical portion of the exhaust pipe section.

8. A device according to any one of claims 1 to 7, wherein said catalyst plate means is composed of one catalyst plate member and is disposed in the diametrically central portion of the exhaust pipe section within a range of 1/3d to 2/3d, wherein a symbol d designates an inner diameter of the exhaust pipe section, offset from an inner surface thereof.

9. A device according to claim 8, wherein said catalyst plate member is provided with a rib portion formed at an intermediate portion thereof.

10. A device according to any one of claims 1 to 6, wherein said catalyst plate means comprises two catalyst plate members disposed diametrically symmetrically in the diametrically central portion of the exhaust pipe section within a range of 1/3d and 2/3d, whrerein a symbol d designates an inner diameter of the exhaust pipe section, offset from an inner surface thereof.

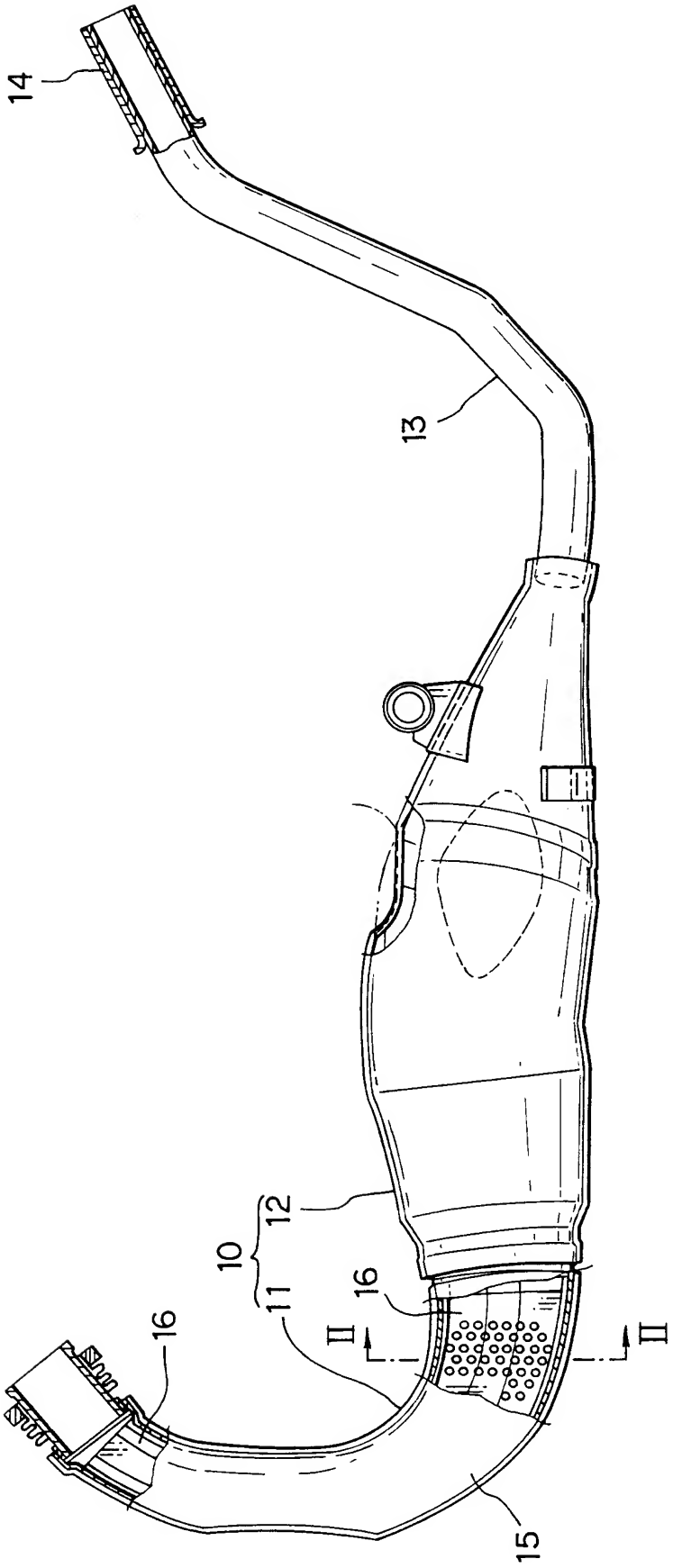

FIG. 1

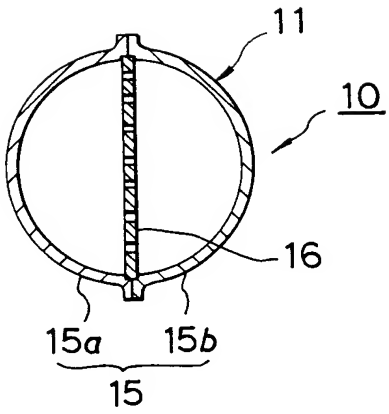

FIG. 2

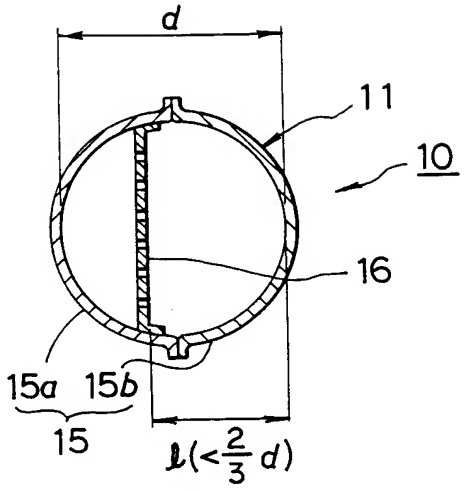

FIG. 3

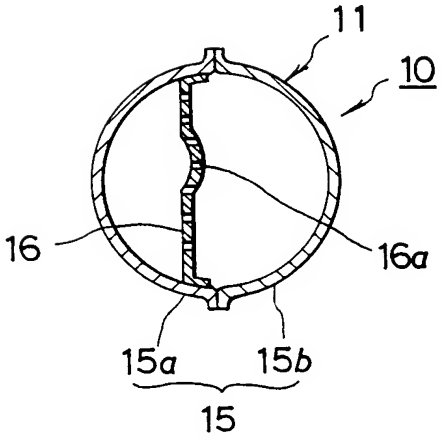

FIG. 4

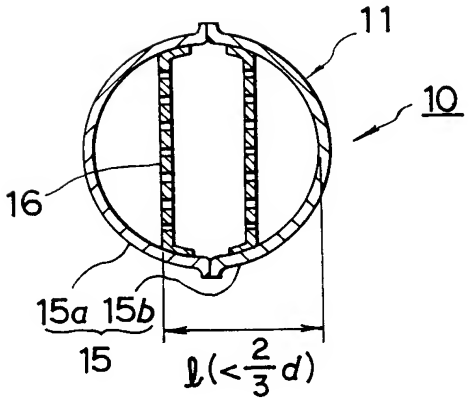

FIG. 5

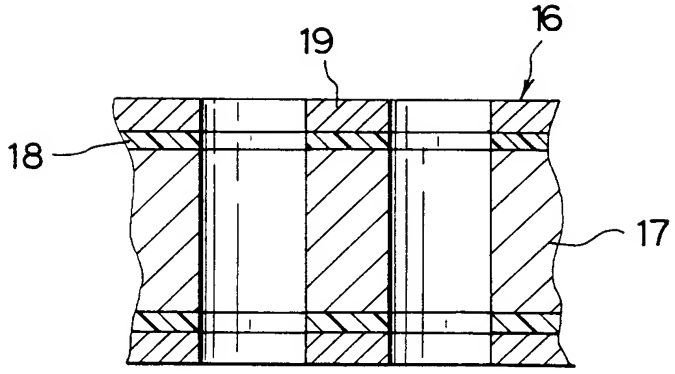
19
16
18
17

FIG. 6

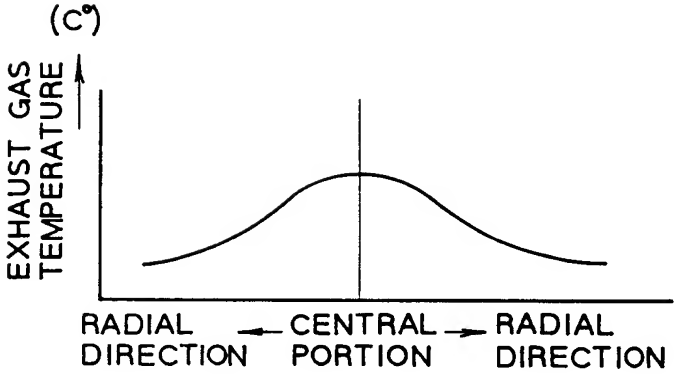
(C°)
EXHAUST GAS TEMPERATURE
RADIAL DIRECTION
CENTRAL PORTION
RADIAL DIRECTION

FIG. 7

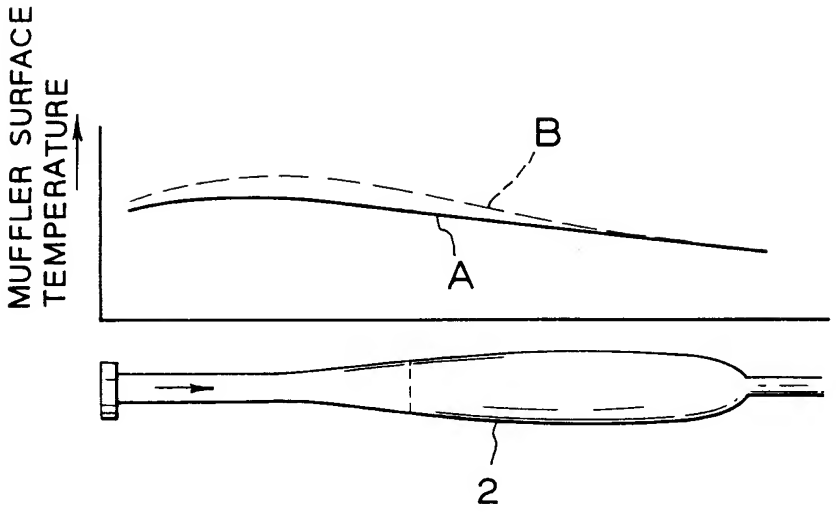
MUFFLER SURFACE TEMPERATURE
B
A
2

FIG. 8

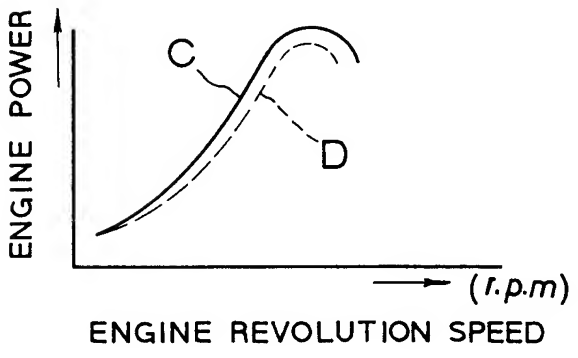
ENGINE POWER
C
D
(r.p.m)
ENGINE REVOLUTION SPEED

FIG. 9

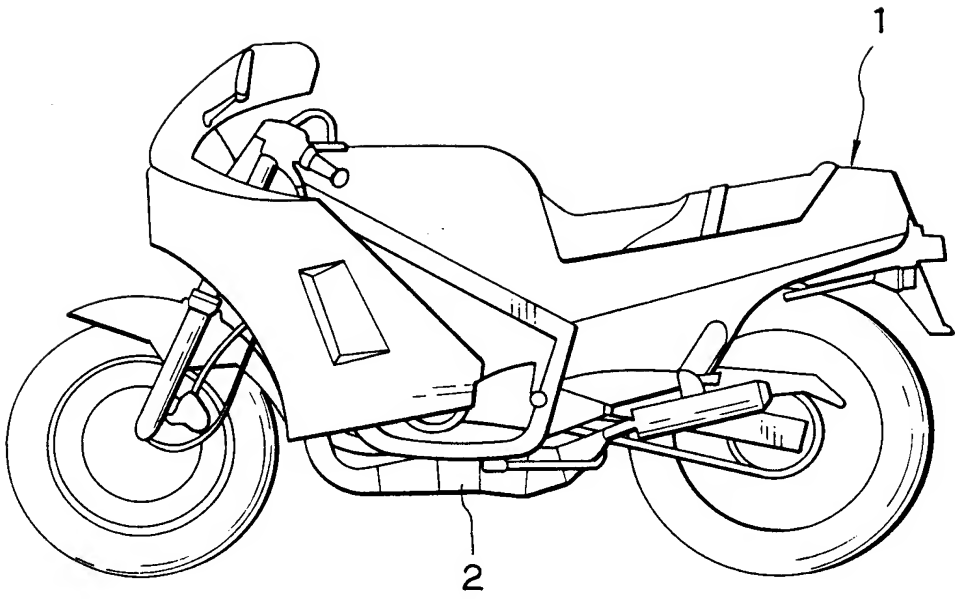

FIG. 10

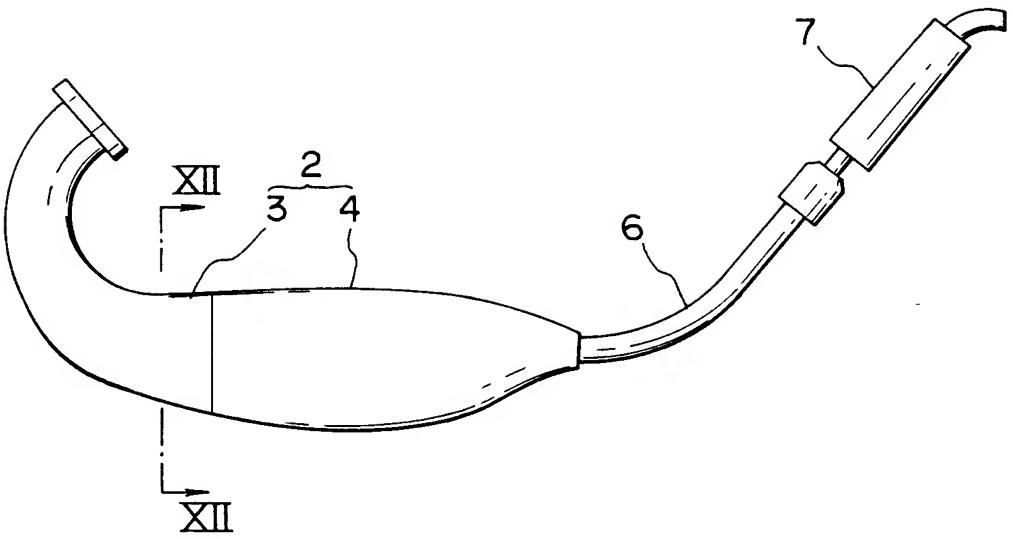

FIG. 11

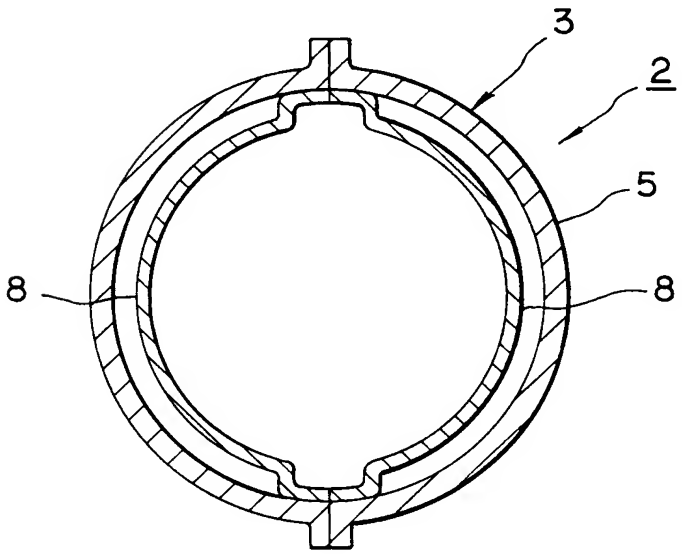

FIG. 12

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 11 4196

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
P,X	EP-A-0 401 195 (LAIMBÖCK) * column 2, line 39 - column 3, line 11; figures * ---	1-4,7	F01N3/28 F01N1/08 F01N7/08
X Y	DE-A-2 942 728 (BREMSHEY) * page 5, paragraph 2; figures * ---	1-4,7 5,6	
Y	FR-A-2 375 449 (ROESSLER) * page 5, line 25 - page 6, line 13 * * page 8, line 28 - page 9, line 20; claims 17,18; figures * ---	5,6	
A	FR-A-2 633 366 (ROSI) * page 5, line 28 - line 32; figures 9,9A * -----	10	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

F01N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	05 NOVEMBER 1991	SIDERIS MARIOS

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

& : member of the same patent family, corresponding document

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